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HAZARDOUS CONTAMINANTS PROGRAMME

Sampling Procedure for Airborne Polychlorinated Biphenyls (PCBs)

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Ontario Ministry of the Environment

The Honourable
George R. McCague,
Minister

K.H. Sharpe,
Deputy Minister

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HAZARDOUS CONTAMINANTS PROGRAMME

Sampling Procedure for Airborne Polychlorinated Biphenyls (PCBs)

A joint development by Technology Development
and Appraisal Section, Air Resources Branch
and Pesticides Section, Laboratory Services Branch -

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PRINCIPLE

PCBs enter the atmosphere through incineration and evaporation processes from various sources including electrical capacitors and transformers, vacuum pumps, heat-transfer systems, gas-transmission turbines, hydraulic fluids, synthetic resins and rubber products. While it might be expected that most airborne PCB's will be adsorbed on suspended particulate matter, recent experimental findings by MOE personnel indicate that they may be present predominantly in the vapour phase.

According to current MOE practices, airborne PCB's are collected on specially designed sampling cartridges containing Florisil as the adsorbent, using a low-volume sampling device, with a flow rate of approximately 7-10 liters per minute and total sample volume of at least 10 m^3. The sampling procedure is generally applicable to other organic vapor pollutants as well, with appropriate choice of adsorbent, cartridge design, flow-rate and total sample volume.

DESCRIPTION OF SAMPLING DEVICE

General Requirements:

Optimum design of a unit suitable for atmospheric surveys for organic vapors using adsorbent cartridges should include the following characteristics:

1) Light-weight, permitting portability for field-use;
2) Adaptability to AC line or battery operation;
3) Pump, designed for continuous heavy duty, should be powerful enough to provide a flow-rate of approximately 10 liters per minute and a relatively large (up to 67.5 kPa) pressure drop for use with a variety of collector cartridge designs.
4) The unit should be equipped with an adjustable flow-control valve and rotameter for control and approximate measure of flow-rate, and an accurate dry gas meter for determination of total volume sampled.
5) Suitable sample inlet and line connections to assure a leak-free system.

TDA's experience so far indicates that Nutech* Model 221 AC/DC Gas Sampler meets the above requirements, but any other suitable sampling device may be considered.

* See note p. 3.

Specifications of the Nutech Model 221 AC/DC Gas Sampler:

A schematic representation of the unit is given in Figure 1.

Physical: Dimensions - 15 1/2"W X 14 1/2"H X 11"D
Weight- 35 lbs.
Cabinet - 0.090" aluminum
Base - 0.125" aluminum
Sky-blue epoxy finish.

Power: 110 V, 60hz AC or 12V DC
Model 221-1A14 draws 2.0-2.5 Amps, depending on flow rate (Max, 60 Amp/hr/day)
Built in battery charger. Recharge time equals approximate running time.

Gas Flow: Max. flow-rate: 10-15 liters per minute.
Flow rate, adjustable with flow-control valve from 0.5 to 10 liters per minute, measured by rotameter.
Digital readout dry gas meter measures total volume sampled to max. 10,000 cu. ft., with readability to 0.001 cu. ft.

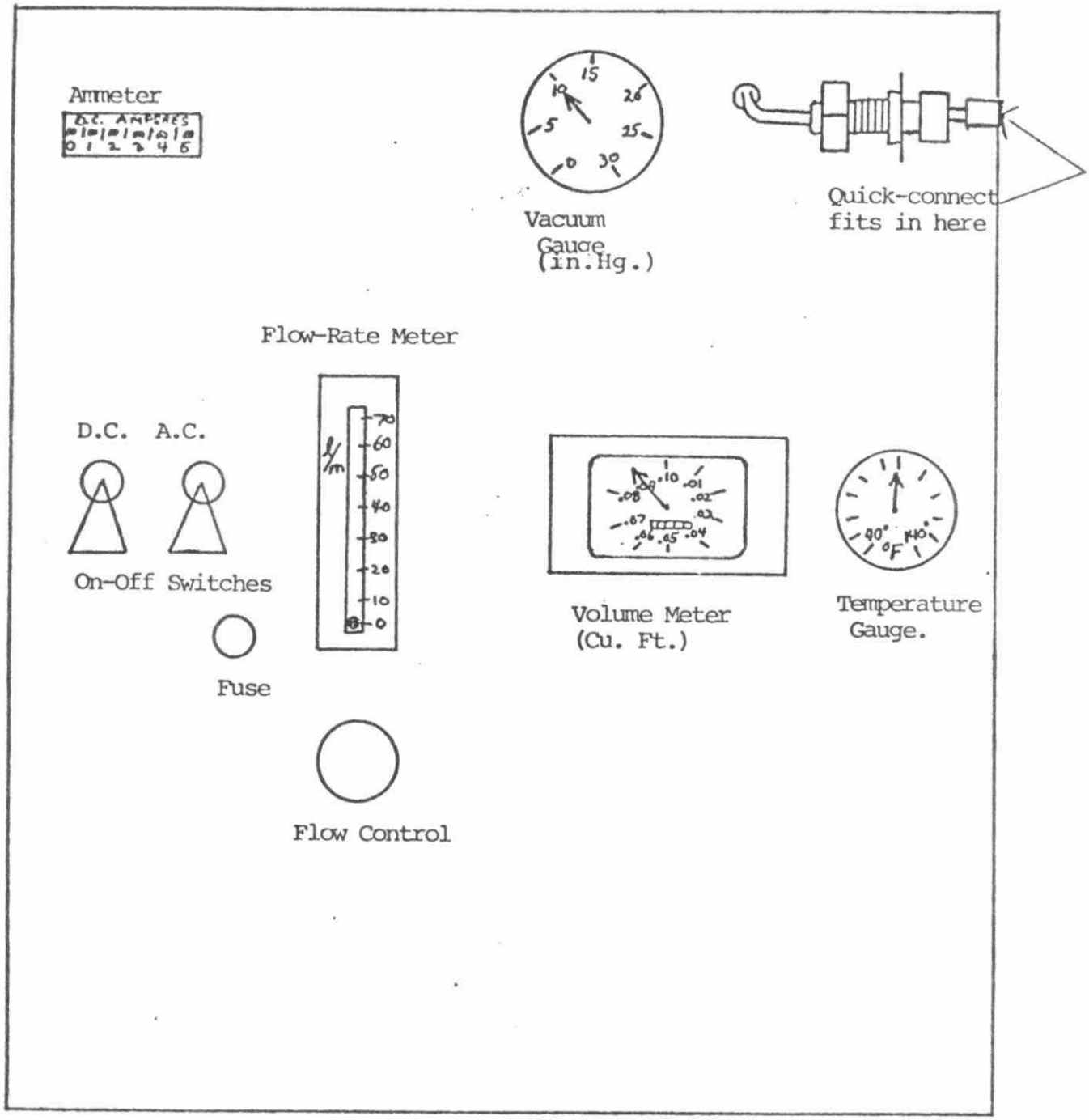
Max. vacuum: 20-24 in. Hg. Vacuum gauge monitors pressure drop across cartridge.

Sample Inlet: 1/4" Quick Connect in upper side, for easy mounting of GC cartridge holder or other suitable sampling connections. Currently available MOE units are equipped with copper tubings and appropriate fittings for air-tight connections of cartridges.

Note: Mention of brands or trade names in this document does not constitute endorsement by the Ministry of the Environment or the Government of Ontario.

FIGURE 1.

PORTABLE "NUTECH" SAMPLER CONTROL PANEL



OPERATION OF "NUTECH PORTABLE SAMPLER:

Power can be supplied either by connections to a battery (Direct Current) or to a line source (Alternating Current). Each sampler has both cords. Switches must be turned on the following way to supply current to the sampler.

Using Battery (DC) Source:

DC Switch ON
or in the up position

AC Switch OFF
or in the down position.

Using Lines Source (AC):

DC Switch On

AC Switch ON

The battery can be recharged at the same rate it was discharged i.e. amp hours to recharge = amp hours used. However, to assure longer life for the battery it is preferable to recharge it at 1/10 AH capacity.

To recharge, battery and line source are hooked up to the "Nutech" portable sampler and switches are turned on the following way:

DC Switch OFF

AC Switch ON

Sampling Attachments

1. The main component of the sample collection system is the adsorbent cartridge, which, for the collection of airborne PCBs, is filled with Florisil adsorbent. A schematic drawing of the cartridge currently used is given in Fig. 2.*

2. The sampling cartridge is connected to the pump through 6.3mm copper tubing which in turn is connected to the sample inlet of the Nutech device by a 6.3mm Quick Connector Lock. 6.3mm Swagelok fittings are used for connections wherever necessary. The cartridge is to be held in an upright position.

3. A pre-filter can optionally be connected in front of the sampling cartridge, as shown in Figure 3. Use of this pre-filter is recommended in especially polluted environments. Its use is not usually required, as the glass wool plug and adsorbent bed capture fine particulate matter as well as vapors.

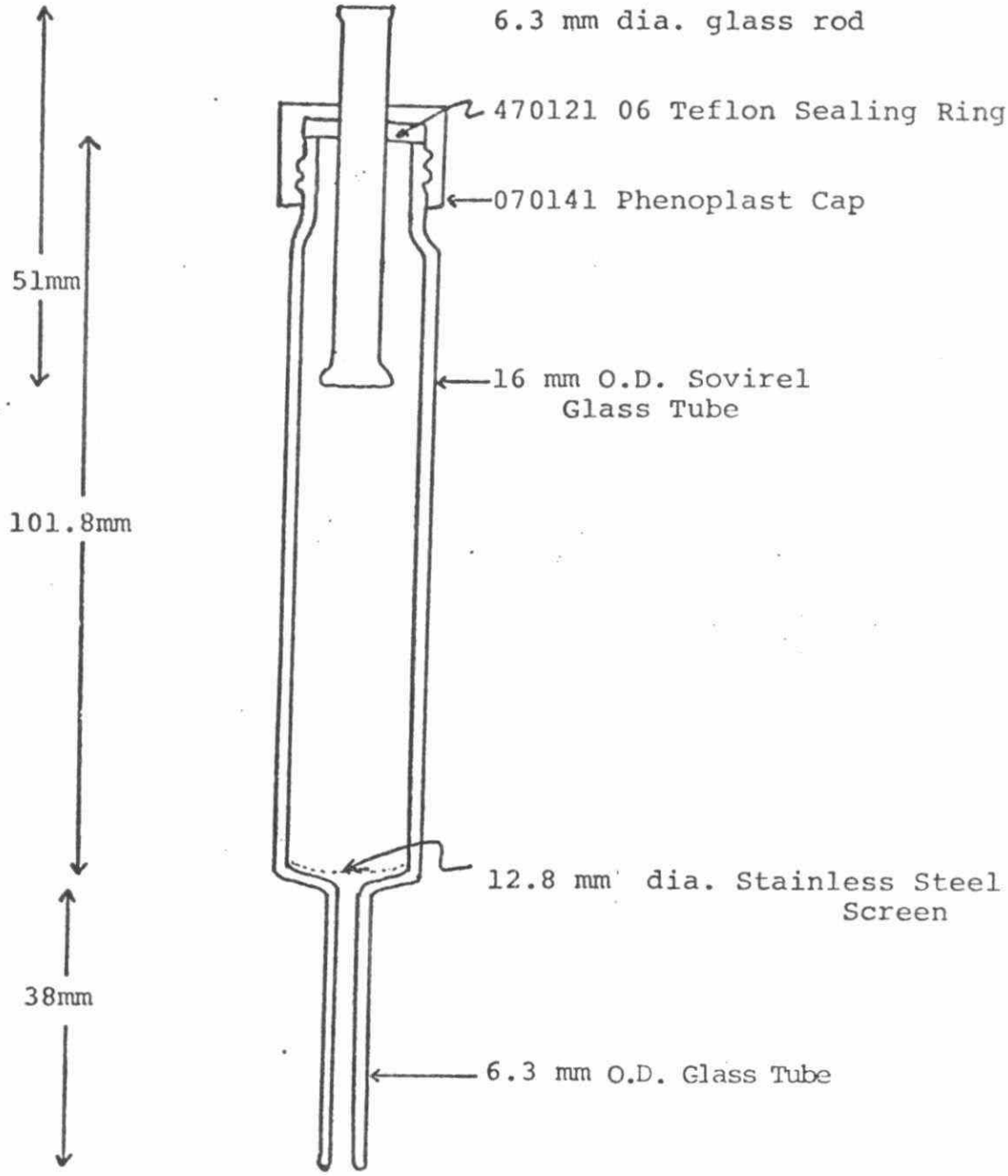
4. Use of a protective bonnet, situated above the sampling cartridge so as to cover it, is recommended to keep moisture and settleable dust out of the cartridge during collection.

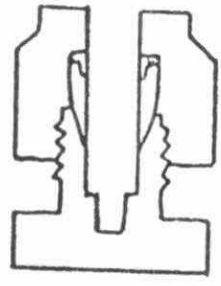
5. All the above mentioned sampling equipment and particularly those being used in front of the sampling train should be kept rigorously clean and all contamination during handling should be avoided.

*NOTE: The purpose of the 6.3mm O.D. glass rod shown in Fig. 2 is to assure that the adsorbent bed is held securely during transportation and to provide an air-tight closure. It is removed during sampling.

Figure 2.

CARTRIDGE DESIGN



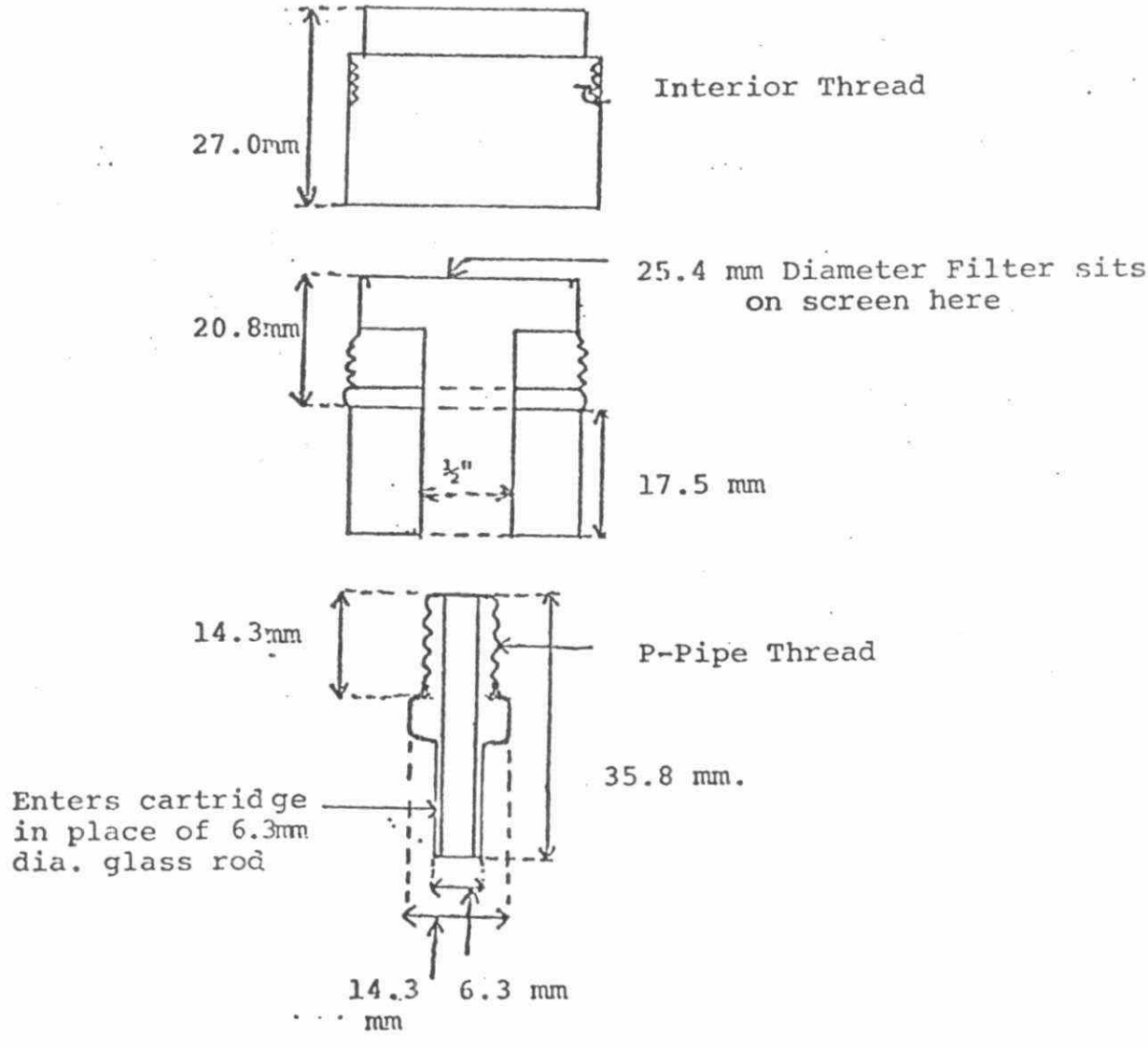


6.3 mm Swagelok Cap (-40°C) Brass Body with Teflon Ferrules (Front and Back)

Alternatively a plastic (TF Cap of identical size may be used.

Figure 3.

Pre-Filter Assembly



SAMPLING INSTRUCTIONS FOR THE COLLECTION OF AIRBORNE PCBs

1) Remove caps and connect Florisil adsorbent cartridge, supplied by MOE Laboratory Services Branch, to sampling device, using 1/4" Swagelok fittings (with Teflon ferrules).
2) Switch on power source as indicated under "Operation".
3) Adjust flow-rate to maximum, using flow-control valve. This will correspond to approximately 7-10 liters per minute, considering the pressure drop across the cartridge. This will vary with the mesh size of the Florisil adsorbent.
4) Continue sampling until a total volume of about 350 cu. ft. (10 m^3) is reached. This may require 24 hours continuous operation.
5) The following information should be recorded:
   (a) Date and time of sample collection.
   (b) Pump model and serial number.
   (c) Cartridge type and sample number.
   (d) Sampling duration.
   (e) Flow-rate (liters per minute, l pm)
   (f) Total volume sampled (cu. ft. or liters to be specified; 1 cu. ft. = 28.31 l)
   (g) Location of sampling, including distance and direction relative to nearby emission sources.
6) Switch power off, remove cartridge from sampling train, replace caps onto both ends of cartridge and ship cartridge with label, bearing sample number, to MOE Laboratory Services Branch for analysis.

N.B. Do not alter any numbering on individual cartridges as supplied by MOE Laboratory Services Branch. These numbers correspond to individual blank runs performed on each cartridge prior to shipping and which may be used in evaluating fuel result. Also, ensure that all connectors, fittings and adsorbent cartridge ends are free from lubricants or other contaminants.

SAMPLING FOR OTHER ORGANIC VAPOR POLLUTANTS

Standardization of methodology for other organic vapor pollutants is currently under development, and specific sampling instructions will be circulated on completion of the development project. So far, charcoal was found useful as an adsorbent for the collection of vapor phase chlorinated aliphatic hydrocarbons in general and vinyl chloride in particular, while Tenax GC was found suitable for the collection of aromatic vapor pollutants such as benzene, toluene, xylene, styrene, chlorobenzene, ethylbenzene etc. Total volume to be sampled varies according to the type and amount of adsorbent used, and its adsorption capacity towards the particular pollutant to be collected. These factors are currently under investigation, as part of a joint development project by the Organic Trace Contaminants Section, Laboratory Services Branch and the Technology Development and Appraisal Section, Air Resources Branch.

ADDITIONAL INFORMATION

Contacts:

Dr. S. Stevens - Supervisor, Technology Development and Appraisal Section, Air Resources Branch.
Telephone: 965-6343

- Contact in advance to reserve sampling unit.

Mr. G. A. V. Rees - Manager, Pesticides Section, Laboratory Services Branch.
- Contact well in advance of survey date to ensure cleaning and filling of Florisil cartridges.

Dr. O. Meresz - Manager, Organic Trace Contaminants Section, Laboratory Services Branch
Telephone: 968-3032

- Contact well in advance of survey date regarding availability of special cartridges for other organic vapor pollutants.

Equipment*

The sampling unit described in this document is available from Levitt Safety Ltd. for approximately $1,400 to 1,600 depending on quantity ordered. Allow 3-4 weeks for delivery.

* See note, p.3.

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